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Factors Affecting the Purchase Value of New Houses

Section I—Introduction and Summary

WHY do some families pay more than others for their new homes? Income is obviously an important reason but what other factors are also important? Are the age, occupation, and education of the household head—to cite a few characteristics—of any significance? If so, how are they related to the amount a family pays for a new home? And how do changes over time in relative prices and credit conditions affect the amount paid?

This article attempts to answer these and related questions. It is the second part of a study of housing undertaken for the Interagency Economic Growth Project. The first part [1] analyzed long-range influences affecting the number of new housing units built and provided alternative projections of the number of new housing units for 1970.

Given the number of units that may be demanded in the future, it becomes necessary to determine average value per unit if projections of aggregate value are required. Although projections of average unit value were obtained by extending past trends, this technique did not provide much in the way of analytical content. This report analyzes unpublished data and yields a number of insights into the demand factors that give rise to variations in the purchase price of new houses. No projections are shown.

Cross-section data

Except in the last section, which is concerned with a time series analysis, most of the data for the present report are cross-sectional and are from the 1960 Census of Housing. The data, which are based on a large sample of buyers of new homes, include an extensive list of characteristics pertaining to the structure and to the household.

The article provides several cross-tabulations that show how the value of a newly built house varies by income class and by other characteristics of the household. Although the sample is a good-sized one, with many cells containing a fairly large number of observations, there are obvious limits to the number of cross-classifications that can be shown and readily interpreted. In order to lay bare the net relationships—that is, the relationship between house value and each of several characteristics of the household, with all other factors held constant—the individual household data have been analyzed by means of multiple regression. The regression analysis is the heart of this report. The basic regression took this general form: The value of a newly built house acquired by a family or individual depends upon the current income of the household; the age, sex, race, education, occupation, and marital status or length of time married of the household head; and the location of the housing unit. Some modifications of this regression were also explored.

A feature of this study is its treatment of a large number of nonincome variables, for which data have not ordinarily been available until recently.[2] The use of such data in statistical analysis had been limited not only because they were scarce but also because many of the variables were nonnumerical. The development in the last few years of new statistical techniques involving the use of "dummy" variables [3] and the availability of large computers have overcome these obstacles

In addition to the analysis of nonincome influences, this article puts considerable emphasis on the estimation of income elasticity—the percentage change in purchase price or value asso-

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1. "Long-Term Influences Affecting the Volume of New Housing Units," *Survey of Current Business*, November 1963.

2. However, nonincome variables have been treated in an analysis of current consumption expenditures for housing. See S. J. Maisel and L. Winnick, "Family Housing Expenditures—Elusive Laws and Intrusive Variances," in *Proceedings of the Conference on Consumption and Saving* (University of Pennsylvania, 1960), Vol. 1, pp. 359–435. Maisel and Winnick found that variables other than income were of little importance in accounting for variation in current consumption expenditures for housing.

3. For a simple explanation of dummy variables, see Emanuel Melichar, "Least Squares Analysis of Economic Survey Data," *1965 Proceedings of the Business and Economics Statistics Section*, American Statistical Association. Recent econometric textbooks also have explanations. See, for example, J. Johnston, *Econometric Methods* (McGraw-Hill, 1963), pp. 221–228.

ciated with that in income. Tests were made to determine if income elasticity is constant throughout the full range of income.

Limitations of cross-section estimates

Although the analysis is based on a rich body of statistical data, the cross-section study has certain limitations:

(1) It applies to a single period. The stability of the relationships shown can be tested only with observations for other periods.

(2) The analysis omits a number of variables that on a priori grounds would appear to be significant in accounting for variation in house value. Some of these omitted variables, such as changes over time in prices and financing terms (including downpayments, amortization period, and interest rates), are for all practical purposes inherent limitations of a single-period cross-sectional approach. For others, such as assets held by the household and the prices of comparable accommodations afforded by used houses, the data were not available.

(3) Although the estimated regression coefficients are statistically significant at the 1 percent level, they have sizable errors; this reflects both sampling variability and intercorrelation among the independent variables.[4]

(4) Certain biases are characteristic of regression computations from cross-section data, as has been widely noted. One type of bias is related to the concept of income that is appropriate for calculating elasticity.[5]

Time series analysis

The final section of this paper uses time series data to analyze the factors influencing house value. Ideally, the results of time series analysis could serve as a check on the cross-section results and would permit the introduction of variables such as price and credit terms that were necessarily excluded in the cross-section approach.

In practice, the time series analysis has serious shortcomings. The various nonincome factors (age, education, etc.) used in the cross-section analysis are not available in usable time series. The few series that are available—on house value, price, income, and credit terms—are deficient in many respects. Moreover, there is a high degree of correlation among the independent variables, so that it is difficult to isolate and appraise their separate relationship to house value. An important characteristic of the available time series is that they are highly aggregative—annual averages for the United States—in contrast to the cross-section data, which are on a household basis.

In the analysis of many other types of problems—consumption functions, for example—estimates based on aggregated time series have usually been considerably different from those derived from cross-section data, and the two types of estimates have seldom been reconciled. In this study, such differences are encountered, and no reconciliation has been achieved.

Principal findings

Points 1 through 5 apply to the cross-section analysis.

(1) All of the independent variables accounted for about half of the total variation in the price paid for new homes.

(2) As was expected, income was the single most important variable, accounting for almost 50 percent of the explained variation in house value.

(3) With all of the other explanatory variables held constant and with the highest and lowest income groups excluded, the cross-section estimates of income elasticity ranged from 0.41 to 0.47. This means that a difference of 10 percent in income was associated with a difference of around 4.1 to 4.7 percent in the value of a newly purchased house. These net regression results were not much different from the simple regression estimate of income elasticity when only income was related to the value of a new house.

(4) The income elasticity estimate was found to be constant over an extremely wide range of income. Other investigations of income elasticity have often found that elasticity declined as income increased.

(5) Several nonincome variables had an important influence upon the variation in house values in the cross-section analysis. For example, with all other factors held constant, an increase in age, years married, or amount of education of the household head raises the value of new homes acquired. Again, with all other factors held constant, homes acquired by white household heads have a higher value than those acquired by nonwhites, and homes in the North and West have a higher value than those in the South.

The following points are from the time series analysis:

(6) When house value was related to family income in a simple relationship based on aggregated data, the estimate of income elasticity was around 0.8. The (net) income elasticity rose to approximately 1.0 when variables for credit terms and prices were added to the estimating equation.

(7) The price elasticity for new houses was estimated to be less than unity, with the usual inverse relationship between price and real value of house purchased. An inverse relationship was also found between house value and a credit variable in the form of monthly mortgage payments, i.e., the lower the monthly payments, the higher the value of house acquired.

The remainder of this article is organized as follows: Section II presents the cross-section data and some preliminary cross-section relationships. In the third and longest section, the data are analyzed by means of multiple regression to show how the value of new houses is related to the income of the household and a series of nonincome characteristics. The fourth section deals with the constancy of the estimated income elasticity throughout the income range and also modifies the cross-section estimate of income elasticity. The fifth and final section is an analysis, based on time series, of income elasticity and the effect of changes in prices and credit on house value.

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4. The standard errors are shown in the Appendix, with only an occasional reference in the text. For the interpretation of errors in regressions containing dummy variables, see Meichar, *op. cit.*

5. Such possible biases have been discussed in numerous publications. Many of these are cited by Margaret G. Reid in *Income and Housing* (University of Chicago Press, 1962). This study and others suggest that estimates of income elasticity for housing derived from cross-section data may be too low. See also R. F. Muth, "The Demand for Nonfarm Housing," in A. C. Harberger (ed.), *The Demand for Durable Goods* (University of Chicago Press, 1960).

Section II—The Data and Their Treatment

MOST of the basic data used in this study were part of a systematic 1-in-1,000 sample of the 53 million U.S. households enumerated in the 1960 Census.[6] For each sample household, the Census Bureau made available on magnetic tapes about 100 characteristics, of which 15 were selected as the most relevant for this analysis. Information from Census tabulations and housing studies was utilized in selecting the most appropriate characteristics.

Table 1.—Number of Households Classified by Tenure Type, April 1960

[Thousands]

	Number	Percent distribution
Total households	52,875	100.0
Owners	32,742	61.9
Buyers, 1955–60:		
Houses built 1959–60	1,398	2.6
Houses built 1955–58	4,677	8.9
Houses built before 1955	6,457	12.2
Other owners	20,210	38.2
Renters	20,133	38.1
In one-to-two-family houses	12,458	23.6
Built 1955–60	883	1.7
Built before 1955	11,575	21.9
In three-or-more-family structures	7,675	14.5
Built 1959–60	159	.3
Built 1955–58	382	.7
Built before 1955	7,134	13.5

Source: U.S. Department of Commerce, Office of Business Economics. Universe estimates based on tabulations from 1-in-1,000 sample of households, U.S. Census of Housing, 1960.

For most of the characteristics except house value and income (e.g., age, education, years married), the Census designations are self-explanatory. The value of the house is that reported to the Census Bureau in answer to the question "What is the current [spring 1960] market value of your house?" Although a householder's appraisal of value may be rather imprecise, especially for older houses, it seemed reasonable to suppose that for newly acquired houses the respondent would give the purchase price. An independent check confirmed this assumption.[7]

Income is measured as the total money income of all members of the household in the preceding year (1959) as reported to the Census Bureau.

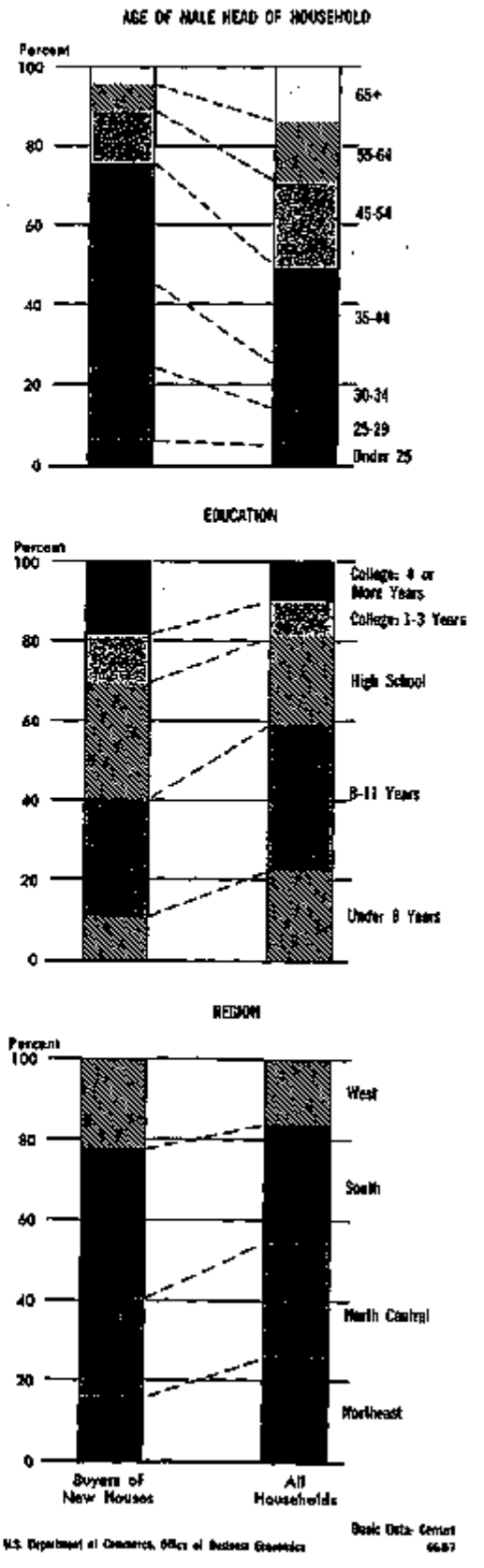
As the first step in this study, the entire Census sample of 53,000 households was classified according to "tenure type." Tenure type designates certain features of the housing unit—whether it is owner-occupied or rented, when it was built, and the number of units in the structure. The various tenure-type classifications, which were derived from the 1960 Census data, are shown in table 1. The portion of the sample that had recently bought new homes constitutes the main set of (cross-section) data analyzed in this article. There were 1,398 observations in this group, of which 1,155 had complete records.

Cross-Tabulations

The group that bought new houses in 1959 and the first quarter of 1960 is shown, blown up to universe totals, in a series of cross-tabulations in table 2. The number of households is shown on the left and average value per unit on the right. The data are classified by income (across the top) and by each of several nonincome categories (in the stub). The first line in the left-hand section shows the 1,398,000 purchasers of newly built houses distributed by income class. The corresponding line in the right-hand section shows the average value of house. The data are all subject to sampling error. (See note to table 2.) Since the information underlying the table formed the basis of the regression analysis, which is discussed in a later section, only a few aspects of the table are presented in this section.

CHART 7

Percent Distribution of Buyers of New Houses Built 1959-First Quarter 1960 Compared With All Households



U.S. Department of Commerce, Office of Business Economics

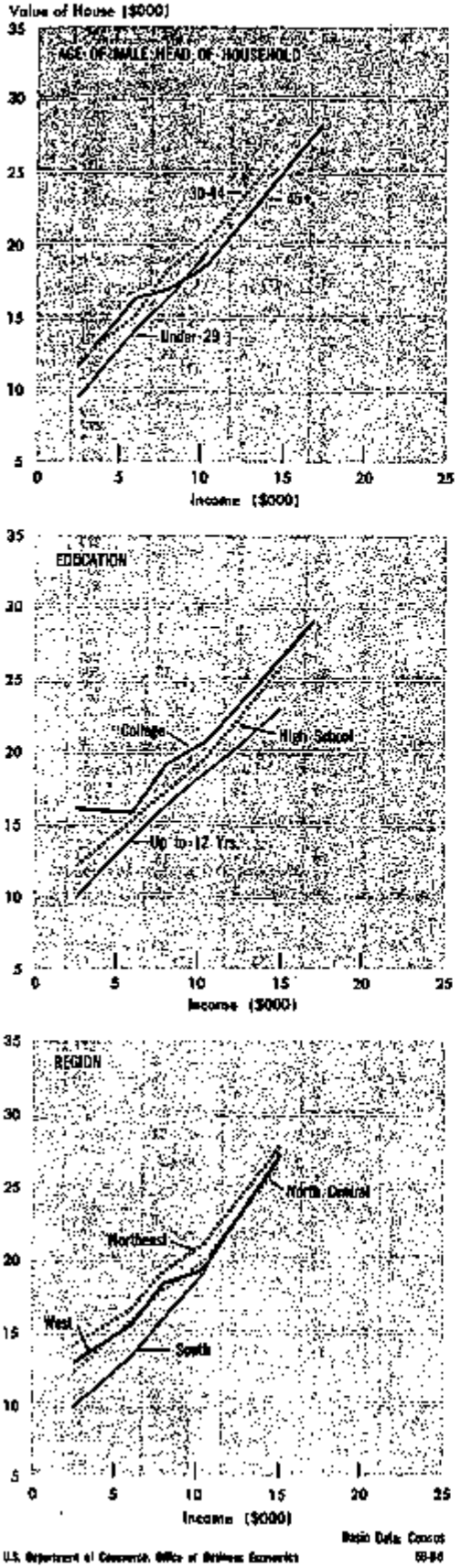
Basic Data: Census 6687

6. U.S. Department of Commerce, Bureau of the Census, *1/1,000 and 1/10,000: The National Samples of the Population of the United States, 1964.*

7. This check was based on a special sample from the 1960 Census—independent of the one being discussed here—that obtained information on the purchase price of newly built homes. The sample ("SCARF") was designed to provide information on the financing of newly purchased homes.

CHART 8

Relationship Between House Value and Income, Buyers of New Houses Built 1959 First Quarter 1960



Some characteristics of new house buyers

Although this paper does not analyze the factors that influence the decision to buy (or not to buy) a new house, some background information on this subject may be of interest. Chart 7 illustrates the relationship between the purchase of a new home and a few of the characteristics considered here. On the basis of data from the left-hand side of table 2, it shows a percentage distribution of buyers of new houses according to each of three characteristics—age, education, and region. For comparison, similar data are presented for all households in the United States as of April 1960.

Among those households that had recently bought new homes, the 10-year age brackets 25 to 34 and 35 to 44 accounted for 70 percent of the total. Those under 25 and those 55 or older accounted for only a small portion of buyers. The age distribution of buyers was quite different from the age distribution of all households. Relative to all household heads (male), buyers were more common for each of the age groups under 45 and less common for each of the older groups.

The amount of education of the household head was directly related to the probability that he would buy a new house. Those whose education did not exceed 7 years were only half as likely to be new buyers as all household heads; those who graduated from college were twice as likely to be new buyers.

As of 1960, the South and the West had higher-than-average proportions of new house buyers relative to all households; the North Central region was a little below average and the Northeast considerably below average.

Some preliminary relationships

Chart 8 suggests some of the ways that house value is related to income and nonincome factors. The top panel shows the relationship between house value and income for three broad age classifications. It indicates three main points: There is a direct relationship between value and income for each of the three classifications; the slopes of the three lines are about the same; and for any given income, there is some difference in the average house value for the different age groups.

The middle panel, in which households are classified by educational attainment of the household head, also illustrates the direct relationship between house value and income. There is less uniformity in the slopes of the lines than there was for the age classifications. Finally, at any given income level, house value appears to vary directly with the level of education of the household head.

The direct value-income relation also shows up when the data are classified by region. However, some clearcut regional differences are apparent with respect to both the slope of the lines and their level. The slope is greatest in the South and least in the Northeast. Throughout most of the income range, house values for any given income level are highest in the Northeast and lowest in the South.

As was indicated earlier, these relationships between house value and income, with one other characteristic held constant, have been presented only to give a taste of the discussion that follows. Their interpretation is deferred to the section dealing with the comprehensive regression analysis, in which both gross and net relationships are considered.

Section III—Regression Analysis

ONLY nine of the characteristics used for the cross-tabulation were used for the regression analysis. As a practical matter, this was the maximum that could be handled in the regression program.[8] The principal new infor-

8. The program was limited to 50 variables, but the word "variables" is used in a special sense here. For example, region is one of the nine characteristics selected for the regression analysis, but each of the four regional subclasses (Northeast, North Central, West, and South) is treated as a separate dummy variable. Appendix table I lists all the variables used.

Table 2.—New Owner-Occupied Houses Built 1959—1st Quarter 1960, by Household Income and Other Selected Characteristics—Number of Households and Average Value of House

[Estimated number of households in thousands—(based on sample)]

	Income groups													
	Under $4,000	$4,000–$4,999	$5,000–$5,999	$6,000–$6,999	$7,000–$7,999	$8,000–$8,999	$9,000–$9,999	$10,000–$11,999	$12,000–$14,999	$15,000–$19,999	$20,000–$24,999	Over $25,000	Total number	Average income
Total units owner-occupied in April 1960, built 1959—1st quarter 1960	250	136	167	175	158	134	82	134	78	49	29	21	1,396	7,578
Age and sex of household head														
Male:														
Under 25 years	23	17	22	11	3	4	(*)	2	(*)	1	(*)	(*)	83	4,851
25–29 years	54	32	36	46	41	23	5	17	3	3	(*)	(*)	262	6,467
30–34 years	32	19	31	47	47	36	27	28	9	5	1	(*)	279	7,267
35–44 years	38	39	45	33	40	44	26	27	43	29	11	9	405	9,559
45–54 years	23	6	18	20	17	16	13	20	13	6	6	9	170	10,814
55–64 years	21	13	10	5	6	5	7	9	5	4	2	3	90	8,594
65 years and over	23	2	3	10	1	4	(*)	3	(*)	(*)	(*)	(*)	56	4,125
All females	48	7	6	3	1	2	2	4	(*)	3	(*)	(*)	73	4,059
Marital status of household head														
Primary individuals	27	4	1	2	3	1	2	(*)	(*)	1	(*)	(*)	41	3,854
Husband-wife married:														
0–2 years	22	9	15	13	6	3	2	4	2	1	(*)	(*)	85	5,747
3–9 years	55	53	62	75	66	45	19	32	8	4	3	(*)	425	5,728
10–19 years	45	41	56	51	53	45	44	46	44	33	18	7	470	9,001
20 years and over	71	23	23	23	25	23	24	43	18	9	5	14	223	9,421
Other families	30	7	7	1	2	1	1	4	(*)	1	(*)	(*)	54	4,277
Size of household														
1 person	27	3	1	2	3	1	1	(*)	(*)	1	(*)	(*)	39	3,892
2 persons	68	31	26	25	30	22	15	33	10	7	4	5	272	7,647
3 persons	57	39	37	33	29	26	22	29	17	9	4	2	316	7,351
4 persons	52	39	55	51	42	40	23	34	15	9	7	7	374	8,205
5 persons	22	22	30	37	32	25	12	20	17	10	2	4	233	8,517
6 persons	10	9	14	14	8	13	10	12	10	4	2	1	107	8,564
More than 6 persons	14	3	4	3	13	5	2	6	4	(*)	1	2	56	9,516
Region														
Northeast	28	18	28	31	26	23	15	29	24	8	3	3	228	8,236
North Central	51	32	40	46	45	29	27	31	16	12	2	6	340	8,044
South	137	63	57	55	54	46	26	36	22	7	7	5	525	6,752
West	35	22	42	41	31	34	26	38	21	13	8	8	309	9,324
Size of place														
Rural farm	19	7	5	4	4	2	(*)	1	1	1	2	1	47	6,532
Rural nonfarm	123	67	62	52	33	35	20	23	15	8	3	4	447	6,432
Inside SMSA, central city	36	32	28	35	26	33	20	28	11	5	3	3	237	8,122
Inside SMSA, not in central city	33	31	57	59	62	45	44	65	32	21	11	13	500	9,429
Other	29	15	17	25	28	19	8	12	7	5	2	(*)	167	7,113
Weeks worked in 1959 by household head														
Did not work	62	10	4	4	(*)	2	1	2	1	2	(*)	1	90	4,011
Under 26 weeks	31	5	3	1	2	1	1	3	(*)	(*)	(*)	(*)	47	3,691
27–47 weeks	44	27	24	15	15	15	5	8	2	2	2	1	157	5,545
48–52 weeks	112	94	136	155	139	115	55	121	71	38	18	20	1,104	8,696
Number of earners per household														
No earners	53	4	3	2	(*)	2	(*)	(*)	(*)	1	(*)	(*)	65	2,892
1 earner	141	88	93	91	83	68	35	67	33	19	12	12	724	7,627
2 earners	53	39	60	76	69	59	46	66	36	14	6	4	525	8,196
3 or more earners	4	5	6	5	4	10	11	13	12	5	2	4	85	11,858
Value of home [1]														
Total	164	107	139	146	138	114	83	119	69	36	17	20	1,155	8,035
Under $8,000	38	10	5	4	(*)	(*)	1	(*)	(*)	(*)	(*)	(*)	47	3,851
$8,000–$7,499	19	9	1	3	1	1	1	1	(*)	(*)	(*)	(*)	41	4,109
$7,500–$9,999	18	11	12	6	4	3	2	2	(*)	(*)	(*)	(*)	58	4,821
$10,000–$12,499	23	26	20	18	26	5	2	3	1	(*)	(*)	1	122	5,832
$12,500–$14,999	20	23	45	33	31	23	18	18	5	1	1	1	235	6,702
$15,000–$17,499	12	15	19	35	23	25	19	17	7	4	2	1	185	8,078
$17,500–$19,999	7	4	14	19	26	24	9	15	5	2	1	(*)	151	8,448
$20,000–$24,999	10	6	14	15	21	24	19	15	15	9	2	2	163	9,772
$25,000–$34,999	7	1	5	7	7	12	10	14	24	12	3	1	113	10,969
$35,000 and over	4	(*)	1	3	2	5	2	4	6	8	9	12	54	22,287
Race														
White	228	128	159	173	153	131	80	130	73	40	20	21	1,342	7,551
Nonwhite	23	8	8	2	5	3	3	4	(*)	(*)	(*)	(*)	55	4,706
Education of household head														
Under 8 years	71	16	14	13	16	7	4	11	1	(*)	1	2	156	5,448
8-11 years	101	54	50	52	47	26	16	32	11	5	2	3	411	5,515
High school	50	45	56	59	48	45	20	35	33	10	3	7	406	8,064
College, 1–3 years	14	16	28	22	23	19	14	23	6	10	5	3	175	9,154
College, 4 or more years	14	11	19	29	23	25	23	34	25	16	9	6	250	10,392
Occupation of household head [2]														
Total	145	102	158	162	148	124	66	128	69	38	19	20	1,139	7,330
Professional and technical	7	9	20	23	22	38	19	23	20	7	3	5	206	9,868
Managers, officials, and proprietors	10	13	20	25	17	19	17	23	10	13	11	12	209	12,967
Clerical and kindred workers	7	9	19	21	11	6	5	11	3	(*)	1	(*)	96	7,131
Sales workers	11	5	12	13	15	6	9	12	3	7	(*)	1	83	8,413
Craftsmen and foremen	39	22	41	34	30	30	22	27	15	4	1	2	282	7,400
Operatives	28	23	21	32	17	13	11	14	10		1		167	6,733
Service workers	13	5	7	2	8	4			1		(*)		39	4,974
Farmers and farm managers	9	4	3	1	1	2					2		23	8,173
Farm laborers and foremen	3	5	1	1	1	1							8	4,812
Laborers, except farm and mine	12	9	7	3	3	3	2	1	(*)		(*)	(*)	39	4,948
Occupation not reported	7	2	2	3	4	1	3	3	3				32	7,578

NOTE.—Averages based on samples of less than 18 are italicized. For a discussion of sampling error, see "Sample Design and Sampling Variability," Part C of the Bureau of the Census publication 1/1000 and 1/10,000.

*The sample contained no observations in this cell.

1. The totals do not add to 1,396, because some were not reported.

SOURCE: U.S. Department of Commerce, Office of Business Economics. Basic data are from 1/1,000 sample of the 1960 Census of Population and Housing.

Table 2.—New Owner-Occupied Houses Built 1959—1st Quarter 1960, by Household Income and Other Selected Characteristics—Number of Households and Average Value of House—Continued

[Average value of house in dollars—(based on sample)]

	Income groups												
	Under $4,000	$4,000–$4,999	$5,000–$5,999	$6,000–$6,999	$7,000–$7,999	$8,000–$8,999	$9,000–$9,999	$10,000–$11,999	$12,000–$14,999	$15,000–$19,999	$20,000–$24,999	Over $25,000	Average value of house
Total units owner-occupied in April 1960, built 1959—1st quarter 1960	18,280	51,850	35,050	35,970	17,470	19,160	10,800	20,800	24,560	27,710	31,390	32,920	16,570
Age and sex of household head													
Male													
Under 25 years	8,630	10,260	12,150	14,200	12,000	15,570	(*)	16,700	(*)	15,800	(*)	(*)	11,280
25–29 years	8,920	10,820	14,040	14,810	16,560	16,170	12,200	19,040	25,220	(*)	(*)	(*)	14,490
30–34 years	12,980	11,450	15,220	15,000	17,040	19,180	19,180	22,190	28,580	35,780	18,800	(*)	17,020
35–44 years	11,180	11,400	14,550	14,780	17,060	19,360	18,410	21,060	29,360	29,320	33,130	33,080	18,870
45–54 years	10,640	12,220	14,020	16,430	16,430	17,090	16,080	18,600	28,980	34,120	37,180	30,440	18,100
55–64 years	9,440	11,850	13,130	13,000	15,180	20,770	12,830	20,360	21,840	25,980	32,900	40,000	16,730
65 years and over	12,630	13,800	13,700	14,470	8,700	25,970	(*)	27,470	(*)	(*)	(*)	(*)	14,700
All females	12,570	15,670	15,170	20,470	15,800	14,620	14,550	17,830	(*)	31,800	(*)	(*)	14,320
Marital status of household head													
Primary individuals	10,560	14,700	8,600	24,360	13,670	14,800	18,050	(*)	(*)	40,000	(*)	(*)	12,840
Husband-wife married:													
0–2 years	9,220	11,310	13,120	12,470	12,780	17,110	18,800	17,070	25,100	16,800	(*)	(*)	13,330
3–9 years	10,260	10,540	14,560	15,890	16,000	16,838	19,260	20,078	27,700	25,800	24,340	(*)	15,200
10–19 years	12,400	11,540	14,890	15,680	17,490	20,068	19,900	21,186	25,000	28,780	30,100	31,100	16,520
20 years and over	10,960	12,930	15,170	18,070	16,650	19,188	15,980	20,580	22,960	24,870	38,470	33,780	17,350
Other families	12,510	16,850	15,040	12,700	18,400	14,800	15,400	17,360	(*)	22,600	(*)	(*)	13,780
Size of household													
1 person	10,540	14,800	8,600	24,360	16,670	14,800	18,700	(*)	(*)	40,000	(*)	(*)	12,810
2 persons	12,130	11,780	15,940	14,940	15,200	18,370	17,260	18,720	24,720	28,130	28,800	32,960	16,288
3 persons	10,220	12,020	14,558	14,360	15,410	16,750	16,900	20,490	21,810	25,900	29,190	40,000	15,480
4 persons	11,550	11,620	13,330	15,300	17,850	18,550	20,120	20,148	26,630	32,000	29,740	34,180	17,010
5 persons	12,560	10,910	15,100	16,660	16,110	19,200	19,890	24,210	27,665	23,450	42,000	29,080	18,120
6 persons	10,540	8,810	14,330	15,490	20,600	19,450	18,740	20,048	22,520	35,000	38,100	40,000	17,320
More than 6 persons	8,950	15,570	18,400	13,700	16,880	21,440	16,200	20,530	16,800	(*)	18,700	33,900	15,410
Region													
Northeast	14,780	13,490	15,290	17,640	17,340	22,290	17,110	33,080	28,450	34,850	38,070	38,100	18,910
North Central	12,230	12,150	14,500	16,870	17,520	18,320	20,370	19,380	23,010	27,470	31,200	31,300	17,170
South	9,770	9,770	12,670	12,690	14,650	17,400	17,520	20,000	25,080	25,210	30,630	35,060	14,190
West	12,050	14,230	15,170	16,640	18,370	18,240	18,620	19,230	21,650	28,920	28,850	35,150	18,380
Size of place													
Rural farm	8,900	10,800	11,400	12,700	13,800	14,800	(*)	17,200	19,400	23,600	25,520	31,600	12,220
Rural nonfarm	9,960	9,520	13,780	14,150	17,530	19,490	15,780	18,990	24,450	26,750	34,130	31,800	14,240
Inside SMSA, central city	13,320	13,170	15,010	16,760	16,570	17,510	20,250	20,990	23,590	31,220	25,000	31,220	17,870
Inside SMSA, not in central city	12,660	14,290	14,670	16,008	18,620	19,028	18,578	21,600	24,550	27,240	29,940	33,220	18,210
Other	10,070	12,470	16,150	15,748	18,150	17,618	17,770	17,230	22,640	21,200	28,700	(*)	13,840
Weeks worked in 1959 by household head													
Did not work	12,198	15,038	13,089	17,150	(*)	18,530	40,000	23,800	(*)	31,308	(*)	40,000	14,590
Under 27 weeks	9,810	8,780	12,870	16,200	12,008	14,800	15,400	18,870	(*)	(*)	(*)	(*)	10,810
27–47 weeks	11,120	11,950	14,180	14,950	14,938	18,580	23,400	18,280	29,700	(*)	31,200	(*)	14,320
48–52 weeks	11,020	11,218	14,220	16,510	15,830	18,520	18,210	20,530	24,130	28,080	30,350	32,490	17,210
Number of earners per household													
No earners	13,950	16,870	20,800	20,600	(*)	19,780	(*)	(*)	(*)	40,000	(*)	(*)	14,328
1 earner	10,550	11,870	15,490	16,758	17,180	19,150	18,580	23,350	28,200	34,250	38,010	33,760	16,970
2 earners	10,978	12,310	12,010	14,178	15,440	18,510	15,550	19,100	22,710	25,136	28,800	35,700	15,088
3 or more earners	8,750	11,800	13,300	9,150	25,670	15,950	16,010	18,140	22,670	18,890	28,100	34,060	13,880
Value of house													
Under $5,000													
$5,000–$7,499													
$7,500–$9,999													
$10,000–$12,499													
$12,500–$14,999													
$15,000–$17,499													
$17,500–$19,999													
$20,000–$24,999													
$25,000–$34,999													
$35,000 and over													
Race													
White	11,620	11,710	14,610	15,550	16,720	18,490	18,500	20,430	24,280	27,280	30,480	32,350	16,330
Nonwhite	6,550	8,090	10,540	11,800	13,670	12,150	23,080	22,150	(*)	(*)	(*)	(*)	10,750
Education of household head													
Under 8 years	8,410	7,870	12,780	13,668	14,460	17,870	21,800	18,028	15,700	(*)	25,800	25,580	11,630
8–11 years	10,490	11,210	13,940	14,680	15,810	17,850	17,070	19,788	21,290	20,460	32,800	34,490	14,450
High school	11,980	12,400	15,420	15,320	16,870	17,188	18,970	21,620	23,600	28,980	29,420	32,820	16,820
College, 1–3 years	14,240	11,780	14,180	17,110	17,120	19,270	23,890	18,360	25,350	29,380	31,720	42,000	18,790
College, 4 or more years	19,720	14,980	14,690	15,980	18,740	20,448	20,640	22,150	28,670	28,810	60,120	35,400	21,228
Occupation of household head													
Professional and technical	16,660	14,668	13,380	16,960	17,840	19,970	19,578	23,168	26,100	24,080	32,470	38,660	19,980
Managers, officials, and proprietors	17,240	11,150	15,520	17,940	18,640	18,810	19,920	21,240	24,760	27,288	33,810	33,970	21,100
Clerical and kindred workers	14,660	13,180	14,770	17,058	16,160	16,940	20,010	19,258	24,350	(*)	16,850	(*)	16,470
Sales workers	13,060	11,960	16,210	16,980	16,690	18,150	18,570	20,780	23,400	22,630	(*)	28,400	17,700
Craftsmen and foremen	9,720	11,190	14,600	14,500	16,310	16,600	17,580	20,250	24,840	26,870	18,200	14,580	15,710
Operatives	9,210	10,570	13,410	13,980	14,380	16,230	14,570	18,100	22,220	(*)	16,600	(*)	13,390
Service workers	11,150	11,500	17,890	14,380	19,370	15,180	(*)	(*)	(*)	(*)	(*)	(*)	14,538
Farmers and farm managers	11,240	11,070	11,330	12,700	13,600	14,500	(*)	(*)	18,400	(*)	28,900	(*)	13,940
Farm laborers and foremen	9,000	10,200	10,000	13,700	20,000	30,000	(*)	(*)	(*)	(*)	(*)	(*)	19,088
Laborers, except farm and mine	8,760	9,010	8,800	14,800	18,450	17,400	26,800	20,008	(*)	(*)	(*)	(*)	14,398
Occupation not reported	12,330	13,700	17,450	18,800	13,700	22,400	15,760	17,858	18,850	(*)	(*)	(*)	13,290

mation considered for the selection process came from the gross relationships developed from the cross-tabulation. Characteristics omitted included some that had seemed likely to be significant in affecting house value—such as the number of children under 18 years and the number of persons in the household. The omission of the latter may seem strange. The number of persons is indeed important in influencing the decision to buy a new house [9] and is directly related to the physical size of housing accommodations. However, family size is not directly related to monthly housing expenditure [10] or to house value, especially after differences in household income are allowed for. From table 2, it can be shown that there is little variation in the house value-income ratio between the two-person and the three-, four-, and five-person households; thus the probability is rather low that household size would account for much of the net variation in house value.

Form of relationship

In the general form of the regression, the value of the house (dependent variable) is a function of income and eight other characteristics of the household or the household head: region, size of place, size of Standard Metropolitan Statistical Area (SMSA) and location within the area, age and sex, length of time married, race, education, and finally, occupation.

In the regression equation shown in this section, the value of the house and income are numerical variables. All the other variables are classified in nonnumerical categories and are treated in the regressions as "dummy" variables, even though some, such as years of education, were originally reported by the household in numerical form.

As would be expected, there was a question as to the appropriate form of the relationship between house value and income. On the basis of past studies, there seemed to be some preference for a log form—i.e., relative differences in income are related to relative difference in house value. However, four forms were calculated: log-log, linear-linear, log-linear, and linear-log. The two mixed forms yielded no improvement in fit and are not shown in the article. There was little difference between the results calculated by the log form and those calculated by the linear form, although the log form accounted for somewhat more of the variation in house value (significant at the 1 percent level).

Summary results of the log equation (#3) are presented first. Then, for the sake of simplicity, a systematic explanation will be made for the linear equation (#1). Because of the general similarity of their results, the two equations are compared only in Appendix table 2.

Summary of Results: Log Equation (#3)

Table 3 gives summary results for the log equation (#3) and shows the relative importance of each of the nine characteristics in explaining the variation in house value. Together, the nine independent variables in the equation accounted for 47 percent of the relative variation in the value of new house acquired. (R^2=0.47.) For time series correlations of highly aggregated data, an R^2 with this value would be unacceptable, but for cross-section data in which the unit of observation is the household, these results appear to be very satisfactory by the usual standard of generally comparable analyses.

Table 3.—Analysis of Variation in Value of New Houses Log Equation (#3)

	Sum of squares	Percent of total	Percent of total explained
Total	58.488	100	.....
Variation explained by regression	28.693	47	100
Variation attributable to:			
Location	(6.570)	(12)	(25)
Region	4.521	8	17
Size of place	.141	(*)	1
Size of SMSA	1.913	3	7
Age and sex	2.134	4	8
Marital status	.842	1	3
Race	.495	1	2
Education	4.304	9	16
Occupation	.966	2	4
Income	11.382	20	43
Variation not explained by regression	29.797	53	.....

*Less than ½ of 1 percent.

NOTE.—Detail may not add to totals because of rounding.
Source: Appendix table 1.

Income was by far the most important variable and accounted for 20 percent of the total variation. Each of the other characteristics also made a significant contribution (at the 1 percent level). Large influences upon variation in house value were exerted by two of the three location variables—region and size of SMSA—as well as by education and age and sex of the head. Smaller but important effects were associated with occupation, length of time married, and race. However, the size of the urban area in which the home was located was not very important. As a group, the nonincome variables accounted for 27 percent of the total variation in the value of new houses or over half of that explained by the regression. On the basis of results obtained from similar studies, it is surprising that the nonincome variables accounted for so much variation.[11]

Income effects

As has already been indicated, income was the most important explanatory variable. In the simple regression between value and income, income accounted for 30 percent of the variation in the value of new houses. As the nonincome variables were introduced into the regression equation, they lowered the net variation explained by income because of the correlation between income and the other "independent" variables. When all the variables were included in the regression equation, the contribution of income was reduced by one-third, from 30 to 20 percent. Although the correlation among the independent variables is substantial, as was expected, the explanatory influence of income still remaining is considerable.

In the log form of the equation, the regression coefficient for income is an estimate of the income elasticity for new house value. In the gross or simple regression, the income coefficient was 0.42; that is, differences of 10 percent in income were associated with differences

9. Maisel and Winnick, *op. cit.*, pp. 879–880.
10. *Ibid.*
11. See Maisel and Winnick, *op. cit.*, pp. 887–892.

of 4.2 percent in house value. This result is consistent with a large number of estimates that have been made in similar analyses of cross-section data.[12] As each of the other significant variables was introduced into the equation, all previously calculated regression coefficients were affected to some extent. The regression coefficient on income declined (with only an insignificant exception), reaching a terminal value of 0.28 when all the variables had been included. A modification of the regression calculation, which is discussed in Section IV, results in an increase in the estimate of the net income elasticity to the 0.41–0.47 range mentioned in the introduction.

The Linear Multiple Regression (#1)

The preceding discussion has shown the relative importance of each of the nine independent variables in accounting for the variation in the value of new houses, and has given one estimate of the income elasticity coefficient. The next step is the consideration of the regression coefficients for the nonincome characteristics, using the results of the linear equation.[13] Each of the variables is discussed in turn. For each characteristic or variable, the coefficients are shown as deviations from the mean, so that for a characteristic as a whole the weighted sum of the deviations is zero.[14] Chart 9 provides a general view of the results. It shows gross differences in house value (expressed as deviations from the mean) for each of several nonincome variables and then gives the corresponding net differences obtained from equation 1. These gross and net differences are discussed in detail in the rest of this section.

Location

Data from the cross-classifications suggest that region may have an important influence on the average value of new houses. For each region, column 1 of the summary table shows the gross difference from the U.S. average house value. Average value is least in the South and highest in the Northeast and West, with the North Central not far above the U.S. average. However, these gross differences in value may reflect not only purely regional differences but also differences associated with regional variations in income, size of city, and age, race, education, and occupation of the household head, as well as factors not included in the regression equation. The net differences among regions, with the influence of all other characteristics included in the regression equation held constant, are shown in column 4. Because income has an important influence on house value and because there are major regional differences in income, the adjustment for income is shown sep-

Influence of Region on Variation in Average Value of New Houses

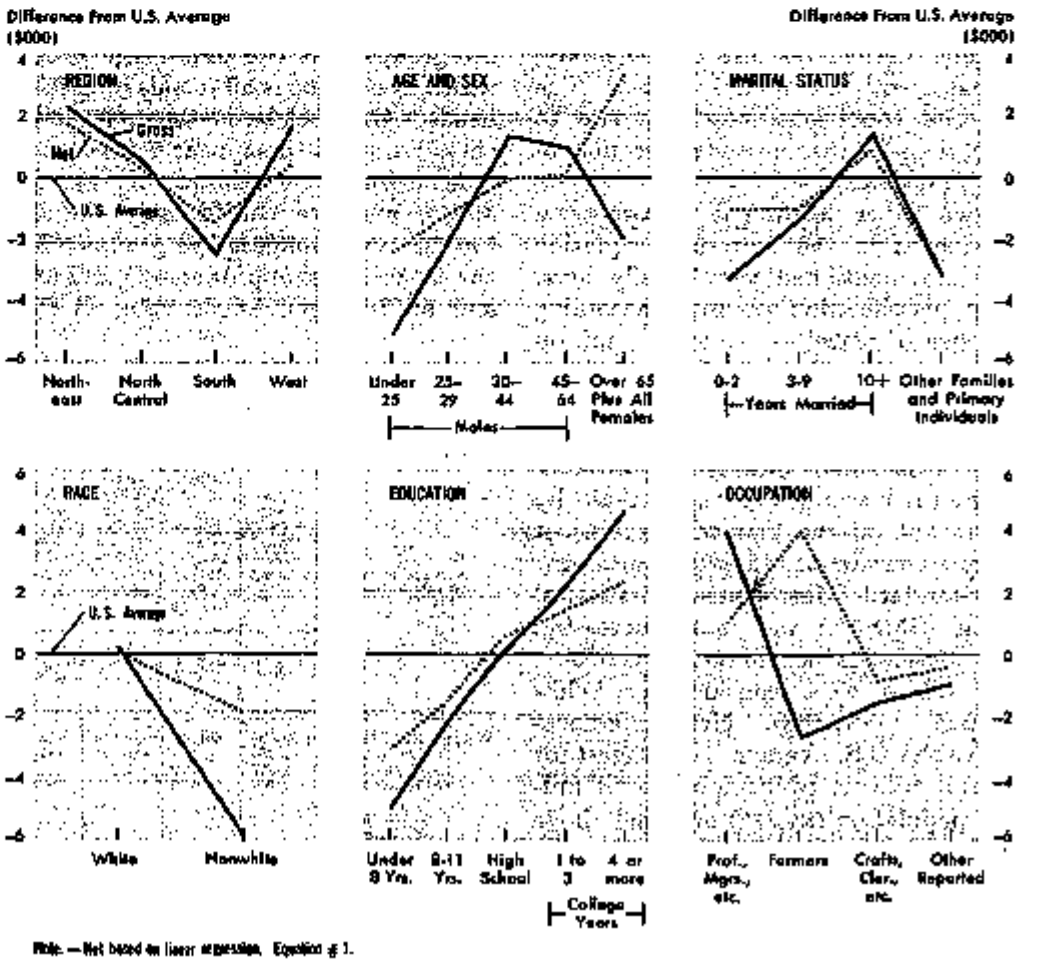
Region	Gross differences from U.S. average	Adjustment for differences attributable to income [1]	Gross differences adjusted for differences in income	Net differences from U.S. average
	Col. 1	Col. 2	Col. 3 = Col. 1 + Col. 2	Col. 4
Northeast	$2,336	−$166	$2,170	$1,790
North Central	596	−77	519	565
South	−3,894	519	−1,374	−1,436
West	1,726	−664	1,062	456

1. Computed by multiplying the differences in income from the national average times the income coefficient from equation #1 (0.4656) of Appendix table 4. The same procedure is followed in the tables for each of the other characteristics.

NOTE.—None of the figures presented here or in subsequent tables have been rounded. For a reference to sampling errors, see note to table 2. For standard errors of regression coefficients, see Appendix table 1.

CHART 9

Gross and Net Difference in House Value From U.S. Average New Houses Built 1959-First Quarter 1960



Note.—Net based on linear regression, Equation # 1.

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12. See summary and criticism in Reid, *op. cit., passim.*

13. In the linear equation, the independent variables account for 42 percent of the variation in the dependent variable. The net income elasticity in the linear equation (at the mean value) is a little smaller than the 0.28 computed from the log equation.

14. This represents a transformation from the coefficients as originally calculated and as shown in Appendix table 1. I am indebted to Emanuel Melichar of the Federal Reserve System for this transformation. (See Melichar, *op. cit.*)

arately in column 2; gross differences adjusted for income are shown in column 3.

Part of the gross variation in each of the four regions is obviously attributable to regional differences in income. The adjustment for income difference is largest for the West, where incomes are well above the national average, and nearly as large (in the opposite direction) for the South, where incomes are below average; for the other two regions, the income adjustment is small. When adjustment is made for the differences among regions in all of the other characteristics, there remain fairly sizable net differences in house value that are associated with region. On a net basis, average value is also least in the South and highest in the Northeast; however, the West, like the North Central region, is only moderately above the U.S. average.

There may be several reasons for the large net differences in house value in the South and Northeast. In the South, they may reflect lower construction costs for a house of specified characteristics, less elaborate heating systems needed because of the milder climate, and lower land values. The opposite conditions may give rise to deviations in the opposite direction in the Northeast.

Two other locational factors were considered in the regression equation and are mentioned very briefly here. First, classification was made according to "size of place"—into rural nonfarm areas, small urban areas, and large urban areas. The net differences in house value for these classifications were rather small, although the variance of the three as a group was statistically significant (at the 1 percent level). A more elaborate classification pertaining to Standard Metropolitan Statistical Areas (SMSA's) was more successful. For households located outside SMSA's, net values were considerably below average (—$1,443). Net differences above the U.S. average were largest for central cities in SMSA's of over 1 million population ($4,273) and well above the U.S. average in suburban (noncentral city) locations in such SMSA's ($1,488). They were only a little above average in SMSA's of less than 1 million, both in the central city ($171) and in the suburbs ($206).

Age and sex [15]

It was apparent from the cross-tabulations that the value of new houses purchased by households with male heads increased directly with age in the younger age groups (under age 35), reached a maximum in the intermediate age groups, and declined for the oldest age groups. A similar pattern prevailed for income in relation to age. Therefore, the question posed was whether there was a net association between age and value of house, that is, one not attributable to differences in income or in other nonincome variables.

The adjustment for income (column 2) is fairly sizable (on a relative basis) for the first three age groups in the table and very large for the two oldest groups. Still, the broad pattern that can be seen in column 1 is evident after the income adjustment (column 3). When allowance is made for all of the other explanatory variables, appreciable net differences in house value associated with age remain only for the two youngest groups and the oldest age group, which also includes all female household heads. On a net basis, the gross differences virtually disappear for the two intermediate age groups, 30–44 and 45–64, and are considerably reduced for the two youngest age groups. For the remaining group (males 65 and over and all females), house value is substantially above average on a net basis—just the reverse of the pattern evident on a gross basis.

Why, after allowance is made for income and other factors, do young household heads buy houses that are less expensive than average while the oldest heads acquire more expensive houses? If it were mainly a question of anticipated family needs and income expectations, one might have looked for just the opposite results: relatively high house values for the young and relatively low values for the old. An influence more powerful than income prospects and anticipated family needs appears to be at work here. Net asset holdings may explain the net results observable in the table. Recent studies have shown a strong positive correlation between net asset holdings and age; table 4 (from a Federal Reserve Board study for 1962) illustrates this relationship. Thus, the effect of asset holdings, a variable that could not be directly measured in the present study, may be indirectly reflected in the net variation associated with age.

Influence of Age and Sex on Variation in Average Value of New Houses

Age and sex of household head	Gross differences from U.S. average	Adjustment for differences attributable to income	Gross differences adjusted for differences in income	Net differences from U.S. average
	Col. 1	Col. 2	Col. 3= Col. 1+ Col. 2	Col. 4
Male under 25 years	—$5,184	$2,340	—$2,854	—$2,361
25–29 years	—2,096	673	—1,422	—1,129
30–44 years	1,367	—349	1,018	—4
45–64 years	1,047	—995	52	138
65 years and older and all females	—2,053	1,778	—324	2,272

15. This analysis is confined primarily to male household heads. The small number of female heads who acquired new houses is combined with male heads 65 years and over.

Table 4.—Estimated Percent Distribution of Number of Families, by Age Group and Net Worth, December 31, 1962

Net worth	Age group		
	Under 35	35–64	65 and over
Total	100	100	100
Negative	21	5	2
$0–$999	20	11	18
$1,000–$4,999	23	19	12
$5,000–$9,999	12	14	15
$10,000–$24,999	19	29	27
$25,000 and over	3	19	28

NOTE.—Detail may not add to totals because of rounding.

SOURCE: The data are based on a survey made by the Bureau of the Census in the spring of 1962 for the Board of Governors of the Federal Reserve System. They appear in Dorothy S. Projector's "Consumer Asset Preferences," *American Economic Review* May 1966, Table A, p. 397.

Table 4 (from a Federal Reserve Board study for 1962) illustrates this relationship. Thus, the effect of asset holdings, a variable that could not be directly measured in the present study, may be indirectly reflected in the net variation associated with age.

Marital status

In the consideration of marital status, comparisons were made for couples married for various lengths of time and for the small number of other households (families with only one spouse present and primary individuals [16])

16. Primary individual households are composed of single individuals or two or more individuals not related by blood, adoption, or marriage. Individuals in one-person households and the designated head of multiperson households of unrelated persons are termed "primary individuals" by the Census Bureau.

Influence of Marital Status on Variation in Average Value of New Houses

Marital status of household head	Gross differences from U.S. average	Adjustment for differences attributable to income	Gross differences adjusted for differences in income	Net differences from U.S. average
	Col. 1	Col. 2	Col. 3= Col. 1+ Col. 2	Col. 4
Husband-wife married:				
0-2 years	−$3,244	$678	−$2,289	−$963
3-9 years	−1,374	526	−848	−848
10 years and over	1,473	−595	878	994
Other families and primary individuals	−3,202	1,733	−1,468	−3,165

that had acquired new homes. These "other households" are not discussed because they are a rather small group and contain several different household types.

For married couples, the gross data show a positive association between years married and purchase price. Differences in income account for roughly one-third of the differences in house value. When all other factors are allowed for, a further sizable reduction is made in the large negative deviation for the group married 2 years or less, but little change occurs for the other two groups. On a net basis, those married less than 10 years buy houses about $1,000 below average and those married longer about $1,000 above average.

It was recognized that the length of time married would be correlated with the age of the household head. Nevertheless, a significant reduction in the variation in house value was accounted for by the length of time married, although the reduction was considerably smaller than that associated with age and sex of the head. It may well be that the years-married variable, like the age variable, reflects the influence of asset holdings on the purchase price of a house.

Race

Nonwhites acquired homes that were valued at $5,000 less than the U.S. average. Of this difference, one-fourth was associated with lower income, and

Influences of Race on Variations in Average Value of New Houses

Race	Gross differences from U.S. average	Adjustment for differences attributable to income	Gross differences adjusted for differences in income	Net differences from U.S. average
	Col. 1	Col. 2	Col. 3= Col. 1+ Col. 2	Col. 4
White	$246	$11	$257	$75
Nonwhite	−3,854	1,453	−4,371	−1,894

nearly one-half (in addition) with other nonincome factors in the equation; the remaining portion was associated with race, as is shown below. The net difference may reflect the effects of the less advantageous financing terms available to Negro house buyers or the other difficulties Negroes face in buying houses in line with their incomes and assets.

Education

The education of the household head was an important influence on value. The net variation associated with education accounted for one-sixth of the variance explained by all the variables.

As the table shows, gross differences in value varied directly and widely with differences in education. The corresponding variation in income accounted for about one-fourth of the gross variation. The other nonincome variables brought about a similar reduction in variation for those with the least and the most education but were not important for those who had some high school or 1 to 3 years of college education.

Influence of Education on Variations in Average Value of New Houses

Education of household head	Gross differences from U.S. average	Adjustment for differences attributable to income	Gross differences adjusted for differences in income	Net differences from U.S. average
	Col. 1	Col. 2	Col. 3= Col. 1+ Col. 2	Col. 4
Under 8 years	−$4,944	$2,113	−$2,831	−$3,002
8-11 years	−2,124	623	−1,501	−1,405
High school	246	−46	150	626
College, 1-3 years	2,226	−646	1,580	1,455
College, 4 or more years	4,445	−1,134	3,492	2,332

The net differences in house value associated with education may well reflect different income prospects. As compared with the less educated, household heads who have graduated from college are likely to acquire homes that are more expensive in relation to their incomes because they have better prospects for rising income throughout their working lives. Lending institutions are likely to take account of such different prospects.

Occupation

Two general points may be made regarding occupation: First, this variable is obviously related to education; second, the classification system leaves something to be desired. It includes two small and poorly identified groups: Those not reporting occupation and "farmers" living in nonfarm areas. In addition, it includes a heterogeneous "other reported" group, which contains laborers, service workers, and salesmen. The findings for the three groups will not be discussed, mainly because they are not significant.

Influence of Occupation on Variation in Average Value of New Houses

Occupation of household head	Gross differences from U.S. average	Adjustment for differences attributable to income	Gross differences adjusted for differences in income	Net differences from U.S. average
	Col. 1	Col. 2	Col. 3= Col. 1+ Col. 2	Col. 4
Professional, managerial, etc.	$3,969	−$1,422	$2,537	$1,064
Craftsmen, operatives, clerical	−1,442	333	−1,109	−805
Farmers	−2,685	790	−1,855	4,039
Other reported	−983	517	−466	−856
Not reported	−1,283	−136	−1,147	−808

The highest skilled group, which embraces professionals, managers, officials, and proprietors, acquired new houses valued at nearly $4,000 above the average; one-third of the gross deviation was associated with higher income, and one-third was attributable to other nonincome factors in the regression. The group classified as craftsmen, operatives, and clerical workers acquired houses valued below the national aver-

age; a little less than one-fourth of this deviation was attributable to below-average income. The nonincome influences brought about a similar reduction, and the net deviation for this class was still below the average (—$800).

The prospect of rising income is probably one factor that explains the above-average house value for the professional and managerial group. Another is that lenders may be favorably disposed toward persons in this occupational group because they experience little unemployment.

Use of regression coefficients: an example

The preceding discussion of net regression coefficients has indicated how house value would vary if all explanatory variables (income, region, age and sex, education, etc.) except the one under consideration were held constant. This section is a digression that illustrates an interesting use of the coefficients.

Suppose one wished to estimate house value for a hypothetical household with a series of specified characteristics. The regression coefficients can be thought of as building blocks to be combined in various ways to yield an estimate of house value. Subject to certain limitations, table 5, which is based on data for 1959 and the first quarter of 1960, illustrates the procedure to be followed.

Table 5.—Calculated House Value for a Hypothetical Household

Average, based on households reporting house value		$17,662
Income	$7,000	
As deviation from mean	—$1,340	—614
Region	South	—1,406
Location	Suburb of small SMSA.	206
Age and sex	25-29, male	—1,139
Years married	3-9	—945
Race	White	75
Education	High school	628
Occupation	Craftsman	—806
Equals: calculated total		14,462

Source: Equation #1; regression coefficients taken from Appendix table 4.

The left-hand column of table 5 gives the general characteristics and the next column the specific values assumed for the household. The third column gives the regression coefficient taken from the tables just discussed (or, more conveniently, from the summary in Appendix table 4).

It should be remembered that the net coefficients have been shown as deviations from the mean; thus, the calculated house value will be the net result of additions to and subtractions from the grand average house value for the entire sample—$17,662.

In the example, it is assumed that the household has an income of $7,000. Since the average for all households in the sample was $8,340, the income coefficient (.4584) is multiplied by the difference ($7,000—$8,340) to yield the adjustment in value (—$614) corresponding to the assumed income. The rest of the adjustments in the illustration are taken directly from the tables. The example chosen yields a house value of $13,659. Similar computations may be made for any set of specified characteristics.

Such a calculation makes use of the assumption that the variables are independent in their influence upon the dependent variable and that their effects are additive in the manner shown.[17] However, this is unlikely to be strictly true, as was indicated earlier. Age and number of years married are obviously related, as are other independent variables. In addition, all of the coefficients are subject to error. Because of these limitations, the results shown must be used with caution; however, they should be of some value to those interested in analyzing housing markets.

17. For a fuller explanation, see J. N. Morgan *et al.*, *Income and Welfare in the United States* (McGraw-Hill, 1962), pp. 608-611.

Section IV—Modification of Estimated Income Elasticity

THE importance of income in the preceding regression analysis has already been made clear. In the four equations that were calculated (two of which have been shown), income accounted for 40 to 45 percent of the explained variation in house value—more than any other single variable.

The next step involves a more intensive analysis of the net regression coefficient on income and an analysis of the constancy of the income coefficient throughout the income range. A straight line fitted to the logs of house value on the logs of income, as in equation #3, assumes that the income elasticity is constant for all income levels.[18] Although it could be ascertained in advance by simple graphic methods that the gross value-income relationship was approximately logarithmic, no such simple expedient permitted the establishment of the net relationship after the influence of the other variables (age and sex, education, etc.) had been accounted for. The usual supposition is that the elasticity would be higher in the lower part of the income range and would decline at upper income levels, as has been reported for many consumption goods in family budget studies.[19]

THIS section produces a modification of the estimate of income elasticity and tests for constancy in a broad range of income. The test is made possible by extending the dummy variable technique—previously employed only with nonincome characteristics—to the income variable. The modification of the estimated income elasticity comes about chiefly through the omission of the two open-end income classes.

Initially, equations #1 and #3 were recalculated (and designated 1A and 3A); for the specific income of each household, 1 of 12 dummy variables representing the 12 income classes was substituted. An advantage of this technique is that it does not require the analyst to specify in advance the form of the relationship between house value and income. As is indicated below, with the dummy variable technique,

18. Each of the other equations involves a specific implication concerning income elasticity. Equation #1 (linear) implies that elasticity rises with rising income; the linear-log combination implies increasing elasticity as income rises and the other implies decreasing elasticity.

19. See, for example, S. J. Prais and H. S. Houthakker, *The Analysis of Family Budgets* (Cambridge University Press, 1955), pp. 96-98.

each income class has its own regression coefficient. Once these have been calculated, it can then be determined whether they show constant, decreasing, or increasing elasticity.

The results of the recalculations are shown in chart 10 and Appendix table 3. The 12 points connected by the heavy black line represent calculated house value based on equation 3A. If a least squares straight line is now fitted through these calculated values, the slope of this line (0.31) turns out to be only a little larger than that of the line *of* net regression on income from equation #3 (0.28). The points for the lowest and highest income classes appear out of line; the inclusion of these two extreme points reduces the slope of the line, as may be seen in the chart.

There seemed to be some merit in establishing a relationship between house value and income with the two extreme income groups omitted. The lowest income group accounted for about 15 percent of the new house sample; the highest group, about 2 percent. The principal reason for excluding the $25,000-and-over income group is that the data do not have a solid basis, since specific income and value data were not available for income above $25,000 and house values above $35,000.

For households with incomes under $4,000, influences other than current income appear to be much more important in affecting the price paid for new housing. This group is unusual in many respects. One-fourth of these household heads did not work at all in the preceding year; it seems very likely that most of these were retired persons, since one-sixth of the group were 65 years of age or older. Such households draw upon accumulated saving from past incomes for house purchases. About one-sixth were female household heads, a much higher proportion than in the total sample; many of these were widows using the proceeds from insurance or inheritance to purchase a house. The group was also probably overweighted with household heads whose incomes were too low to obtain funds through ordinary financial channels and who obtained family loans or gifts.

In the bottom part of chart 10, a least squares line has been fitted to the results (logarithms) of equation 3A, excluding the two open-end classes; it yields an income elasticity of 0.41, as compared with 0.31 based on all the income classes. It can be seen, moreover, that the line fits the points well, so that it is fair to conclude that the income elasticity is constant through the income range of $4,000 to $25,000.

Results based on equation 1A (which is like equation #1, except for the substitution of dummy variables) also tend to confirm the finding that income elasticity is essentially constant throughout the income range of $4,000 to $25,000. The slope of the line based on equation 1A is 0.47, somewhat above the slope based on equation 3A. [20]

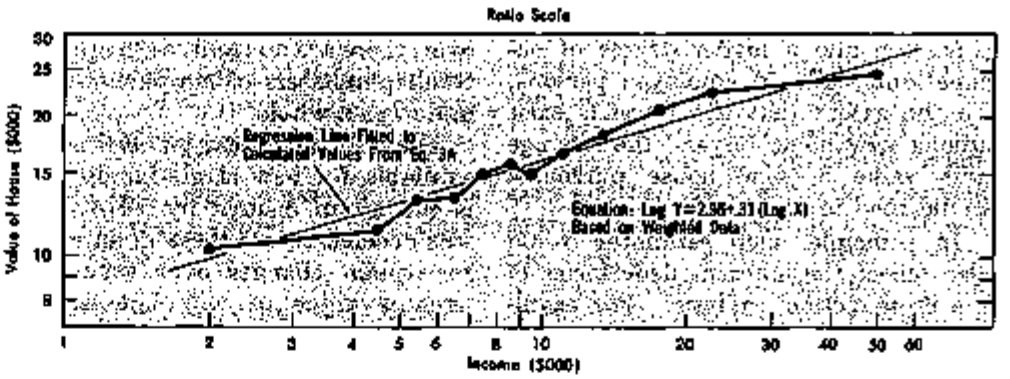
These adjusted estimates of income elasticity based on net regression are about the same as the simple regression estimates derived from the relationship between house value and income for all income classes. They are also within the fairly narrow range reported by other investigators using cross-section data of fairly recent vintage and only one or a very few independent variables.

20. The Durbin-Watson values for the two equations are 2.58 for equation 3A and 1.44 for equation 1A. These are nonsignificant values at the 5 percent level, and (for a cross-section regression) they indicate no significant departure from linearity for the log variables fitted.

CHART 10

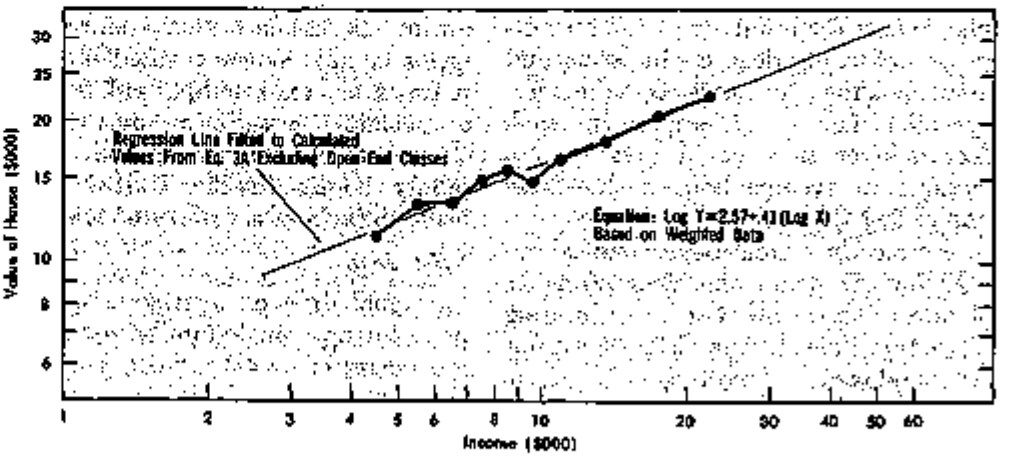
House Value-Income Net Regression, Buyers of New Houses Built 1959-First Quarter 1960

When open end income classes are included, the slope of the net regression line is reduced



When open end classes are excluded, the slope is increased

The equation shows constant elasticity throughout the income range from $4,000 to $25,000



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Section V—Time Series Analysis

If time series data on income and nonincome characteristics of house buyers were available, it would be possible, through the use of the coefficients obtained in the cross-section analysis, to make estimates of house value over time. This approach would permit one to take account of shifts in the various characteristics that were shown to be important in influencing the value of new house acquisitions. For example, there have been trends toward increased education and a higher degree of occupational skills of employed persons. To the extent that these trends exist among new home buyers, the average unit value of new house purchases would tend to rise.

In principle, such estimates would also reflect the inherent deficiencies of the cross-section analysis. For example, they would ignore changes in average unit value that were due to changes in relative prices, credit terms, or asset holdings. At any particular point in time, the variations observed in average unit value among households may reflect the influence of the prevailing structure of prices, credit terms, and asset holdings, as well as other unspecified factors. Changes in such factors over time could give rise to changes in average house value from one period to another.

In practice, time series are not available for the nonincome characteristics of house buyers, so that an estimating procedure like the one outlined cannot be employed. Nevertheless, a time series analysis was made, using aggregative data on prices, credit, and income. Such an analysis does not explicitly provide for variables that, according to the cross-section analysis, affect average unit value. However, it may shed some light on the effect of variables previously ignored in this study.

The available time series data have serious shortcomings. Our main interest is in changes in the average U.S. value of all new nonfarm houses in real terms, but a suitable series is not available even on a current dollar basis, much less on a constant dollar basis. The available price series (for deflation purposes) have major deficiencies. Moreover, there are no credit data applicable to all purchasers of new houses in the nation as a whole.

The only consistent set of time series available for new single-family houses is the group insured by FHA, and it was decided to use these in an attempt to explain changes over time in the average value of new houses. Consistency of data is a considerable advantage in any statistical analysis; it may yield results that are biased with respect to the entire nation but provide analytical insights that might otherwise be obscured by faulty data. The following discussion will therefore be in terms of new houses insured by FHA. Afterwards, an attempt will be made to explain the variation over time in the construction cost of all new single-family houses in the United States, using data from a variety of sources.

FHA data

Annual data on average acquisition price for new single-family homes with mortgages insured by FHA under Section 203 are available from 1947 to 1964.[21] The data are broken down into value of site and value of house. To deflate value of house excluding site, a special cost index, based mainly on FHA cost estimates of a standardized house, was used.[22] This index rose about half as fast as the Boeckh index over the postwar period. No price series was available to deflate the market value of the site. It was assumed that the change in market value reflected price change only. The addition of the site value for a single year (1958) to each of the annual estimates of deflated construction cost for the house itself (in 1958 dollars) yields a deflated series on average value including site. It should be noted that this deflated series, following a general rise throughout the earlier postwar period, declined slightly after 1957 and then edged upward.

The income series used is the "effective income" of purchasers of new FHA houses. This is estimated by FHA to be the mortgagor's earning capacity (before deduction for Federal income taxes) that is likely to prevail during approximately the first third of the mortgage term. Current earnings are adjusted by FHA if they are considered to be partly of a nonpermanent character. Ordinarily, future increases that may be anticipated by the mortgagor are not included in the FHA estimate of effective income. The income series was deflated by OBE's implicit price deflator for personal consumption expenditures to obtain real income in 1958 dollars.

The price index is derived by combining the separate indexes for house and site. Since the values of residential building lots have shown a considerably larger relative rise than construction costs over the postwar period, it may be noted that their inclusion results in a more rapid rise for the combined cost of a house and lot in the years 1947–64 than for the construction cost of a house exclusive of lot.[23] The combined price index

21. Data for 1950 and 1952–64 appear in the 1964 annual report of the Housing and Home Finance Agency, Part II, Section 2. Data for other years appear in earlier reports.

22. The FHA indexes were available for 1947 through 1958 from unpublished FHA records. For the period 1959–64, estimates were made by OBE on the basis of a variety of sources. The most important was Samuel L. Brown's *Price Variation in New Houses, 1959–61* (unpublished paper for the Bureau of the Census).

23. By coincidence, the combined cost of house and lot treated this way moves rather closely with the Boeckh construction cost index for houses exclusive of lot.

was divided by the deflator for personal consumption expenditures to yield a series on the relative price of new houses of fixed specifications.

In general, it was thought that credit would influence house value in two main ways: by its effect on the downpayment and by its effect on the monthly payment on interest and principal. The monthly payment is a composite that reflects the size of the mortgage, the rate of interest, and the length of the amortization period. Other things being equal, the lower the downpayment or monthly payment, the more expensive the house the purchaser may be expected to buy. There are complications, however. In some cases, a given change in credit conditions may affect both monthly payments and downpayment, and in opposite directions. For example, a change in the downpayment requirement will change the size of the mortgage and thus the monthly payments. In other cases, a change in credit conditions—e.g., a change in interest rates—will affect monthly payments but not the downpayment.

Considerable information on downpayment, length of mortgage term, and mortgage interest rates is available from FHA. An attempt was made to introduce these factors explicitly as separate independent variables; because of intercorrelations, the results were not satisfactory. In particular, the coefficients for the downpayment ratio and for the mortgage interest rate usually had the wrong sign. Accordingly, it was decided to combine the separate credit elements into a composite credit factor that would reflect changes in monthly payments.[24]

Several ordinary least squares equations were fitted to the data for the years 1947–64, using deflated average annual acquisition price as the dependent variable and real income, relative price, credit terms, and a time trend as independent variables.[25] All variables were expressed in logs. Generally speaking, the results yielded high coefficients of determination. Results of the equation with income, price, and the composite credit variable just cited are shown immediately below. The basic data are shown in Appendix table 5.

$$V_{FHA} = \underset{(.002)}{1.63} + \underset{(.09)}{1.15}\,Inc. - \underset{(.40)}{.74}P - \underset{(.07)}{.34}\,CCF$$

$$\bar{R}^2 = .982;\ D.W. = 1.38.$$

where

V_{FHA} = log of deflated value ("acquisition cost") of FHA new one-family houses in 1958 dollars.

Inc. = log of deflated "effective income" (in 1958 dollars) of FHA home buyers.

P = log of deflated price index for a standardized FHA house (1958 = 100).

CCF = log of composite credit factor.

As can be seen from the $\bar{R}^2$, the fit was quite good. The intercorrelation between the independent variables was high, as is usually the case in such regressions, and the Durbin-Watson test (D.W.) indicates that serial correlation was significant at the 5 percent level. Coefficients of the three independent variables all have the expected signs. The coefficients for income and credit are several times their respective standard errors, and the price coefficient is 1.85 times its standard error. The income elasticity coefficient is above unity (1.15).[26] This estimate based on annual averages of new FHA houses is substantially higher than the cross-section elasticity estimate based on the household data in Section II.

The price-elasticity coefficient of −0.74 is about midway in the range of estimates reported by others.[27] The price index data for houses, however, are of such limited quality that comparisons are not completely valid. The standard error for the price coefficient is relatively larger than the errors associated with the two other coefficients, and as is illustrated below, the price elasticity coefficient was rather unstable. The standard error at 0.4 means that a range of one standard error about the coefficient extends from −0.34 to −1.14.

The final variable in the equation is the composite credit factor, which reflects the combined influence of shifts in downpayment and mortgage ratios, mortgage yield, and length of amortization period on monthly payments. According to the equation, a 10 percent reduction in monthly payments as a result of a change in credit terms is associated with a 3.4 percent increase in the value of house acquired.

When a time trend was added to the equation, it was not statistically significant and had little effect on the value of the other coefficients; it is omitted in the equation shown. Other options were also tried. For example, the use of the Boeckh index as a deflator for house value in place of the FHA series for the cost of a standardized house resulted in little change in the coefficients, except that the income elasticity estimate was reduced to less than unity. The equation in logs is:

$$V_{hk} = \underset{(.002)}{1.97} + \underset{(.12)}{.90}\,Inc. - \underset{(.30)}{.73}P_{hk} - \underset{(.10)}{.46}\,CCF$$

$$\bar{R}^2 = .933\ \ D.W. = 1.42$$

24. The composite credit factor is based on an index of monthly payments on interest and principal. It was derived by multiplying an index of the amount of the mortgage by an index of cost per dollar of mortgage. Cost per dollar of mortgage was computed from the standard formula for level (equal) monthly payments, based on the interest rate and the length of the amortization period.

At any given time, downpayment ratios vary directly with house value. A shift over time toward more expensive houses would therefore tend to raise downpayment ratios in the absence of any change in credit conditions. In the derivation of the composite credit factor, it was necessary to exclude the influence of such shifts in order that the credit factor might reflect only changes in credit over time.

For interest rate, mortgage yield rather than nominal interest rate was used in all calculations.

25. This formulation ignores the effect of shifts in supply. For the implications with respect to the estimated parameters, see Harberger, op. cit., pp. 7–8.

26. It may be noted that this coefficient is about twice as high as simple regression cross-section calculations within each year from the FHA data; these calculations have not been presented in this report. The estimated income elasticity based on the time series regression of FHA house value on effective income alone is 0.78.

27. The range of estimates of price elasticity for housing is extremely wide, varying from −0.08 by James S. Duesenberry and Helen Kistin ("The Role of Demand in the Economic Structure," in Wassily Leontief [ed.], *Studies in the Structure of the American Economy* [Oxford University Press, 1953], p. 467), to more than −1.0 by Muth (op. cit., pp. 72–73), and −1.4 by Tong Hun Lee ("The Stock Demand Elasticities for Nonfarm Housing," *Review of Economics and Statistics*, February 1964, pp. 82–89).

The symbols are the same as above, with the subscripts bk referring to the Boeckh index. The equation containing the Boeckh index did have a time trend, which was not quite significant at the 5 percent level. The inclusion of the time trend in the Boeckh equation reduced the price elasticity coefficient so that it was no longer statistically significant. Finally, an equation was also fitted using the previous year's house value as an independent variable.[28] The results were similar to those shown in the equation above, with an insignificant contribution of the lagged variable.

Other time series regressions

Since one would like to know how the value of all new houses—rather than FHA houses only—is related to income, price, and credit influences, a similar set of time series regressions was attempted for all single-family houses in the nation. The series on house value was based on the regular Census series on the construction cost of one-family nonfarm houses. The income series is the OBE personal income data divided by number of households; this average for all households is used rather than a series on the income of buyers of new houses. The deflations were carried out in the way described earlier. For the deflated house price series, alternatives based on FHA and Boeckh cost indexes were employed. The credit series was the same as that used in the FHA regression.

The results were less satisfactory than those obtained in the FHA equations. The income elasticity estimate was about the same, i.e., around unity. The credit term variable taken from the FHA data had a coefficient about the same size as in the FHA regression, but the standard error was much larger than before and not quite significant at the 5 percent level. For the price elasticity coefficient, no meaningful results were obtained with either the FHA cost for a standardized house or the Boeckh series. Finally, the use of lagged variables resulted in little change in the estimates of elasticity.

Evaluation of results

A major contribution of the time series analysis is the fact that credit terms appear to have significant and important effects on house value and that relative prices are important in some formulations. The extent to which the various net regression coefficients derived from the 1960 cross-section household data were affected by the particular pattern of prices and credit terms prevailing at that time cannot be determined, as was already indicated.

The net coefficient on income from the FHA time series data (after the introduction of price and credit variables) turned out to be considerably greater than the cross-section estimates based on individual household data. The two sets of data are, of course, not comparable in terms of coverage. Conceivably, the use of "effective income" in the FHA data rather than actual income could account for some of the difference in the two estimates of income elasticity, but a limited test suggests otherwise. For 6 years—1958–64—both "effective" and actual income data were available from FHA reports. For the years 1959–63, the ratio of actual to effective income varied by only 1 percent; only in 1964 did actual income increase much more sharply than effective income.[29]

There may be nonincome influences that are not included in the time series regression and that partially account for the difference in the two estimates of income elasticity. One such influence may be education, as was suggested in the introduction to this section. Differences of this kind are by no means unique to this study. More comprehensive data are clearly needed before a start can be made in resolving the differences between the two basic approaches.[30]

28. The rationale for the use of a lagged variable in such a demand function may be found in Marc Nerlove, *Distributed Lags and Demand Analysis for Agricultural and Other Commodities*, Agricultural Handbook No. 141 (U.S. Department of Agriculture, Agricultural Marketing Service, 1958).

29. It is of interest to note that at a given point of time—for example, 1964—actual income exceeds effective income for FHA purchasers throughout the income range and that the ratio of actual to effective income declines as one proceeds up the income scale.

30. Differences between estimates of elasticities derived from cross-section data and those derived from time series data have been analyzed in the considerable technical literature on the subject. An early comparison is that of Trygve Haavelmo in "Family Expenditures and the Marginal Propensity to Consume," *Econometrica*, October 1947, pp. 335–341. Edwin Kuh and John R. Meyer, in an evaluation of demand elasticities ("How Extraneous are Extraneous Estimates?" *Review of Economics and Statistics*, November 1957, pp. 380–381), observe that "the kind of behavior measured from cross-section data is commonly long-run in nature, while that which one observes with annual time-series data is more often of a short-run character." Their major illustrations are in food demand studies. Jean Crockett has made a number of contributions on the subject, the latest of which is "Income and Asset Effects on Consumption: Aggregate and Cross Section," *Models of Income Determination* (National Bureau of Economic Research, 1964), pp. 97–132.

Appendix—Technical Note

Each characteristic in Appendix tables 1 to 3 has a line designated "omitted" variables. The use of an omitted variable is a computational requirement for a regression equation containing dummy variables.

In effect, the omitted variable has a coefficient that has been arbitrarily set at zero; it may be considered a standard. For any particular characteristic, coefficients for the other variables are shown as deviations from the value of the omitted variable. A variable whose coefficient is less than twice the standard error shown is not significantly different from the omitted variable at the 5 percent level.

For the linear equation (#1) shown in the text tables and in Appendix table 4, a transformation was carried out in which the coefficients are shown as deviations about the weighted mean for each characteristic. The weighted sum of these deviations is zero. The transformation was carried out in order to simplify the presentation of the regression results.

Appendix Table 1.—Regression Summary for Value of New Houses Built 1959—First Quarter 1960

	Equation #3 (log)	Equation #1 (linear) (in millions)
Total Sum of Squares	53.47967	75.849
Due to regression	26.68817	33.870
Deviations from regression	22.79570	42.979
R^2	.472	.424
Degrees of freedom	1,116	1,116

Variable	Regression coefficient	Standard error	Mean square	Coefficient	Standard error
Constant	3.6780	4.4922		21,339	1,962
Region:					
Northeast	.0965	.0151	1.8925	3,196	592
North Central	.0719	.0136	1.8127	1,971	534
South (omitted variable)					
West	.0661	.0134	1.0055	1,892	527
Size of place:					
Rural nonfarm	.0334	.0473	.0228	1,514	1,857
Urban—Less than 500,000	.0637	.0456	.1126	1,777	1,791
Urban—500,000 or more (omitted variable)					
Size of SMSA:*					
Outside SMSA	—.0771	.0150	1.5189	—2,931	590
SMSA—1 million and over					
Central city	.0939	.0452	.2803	2,785	1,776
Not in central city (omitted variable)					
SMSA—under 1 million					
Central city	—.0290	.0166	.1110	—1,317	652
Not in central city	—.0135	.0146	.0997	—1,282	572
Age and sex of household head:					
Male under 25 years	—.0621	.0266	.3143	—2,357	1,043
25–29 years	—.0296	.0163	.1891	—1,135	641
30–44 years (omitted variable)					
45–64 years	.0108	.0141	.0338	142	556
Male 65 and over and all females	.1385	.0264	1.5963	3,377	1,030
Marital status of household head:					
Married 2 years or less	.0080	.0236	.0007	—35	926
3–9 years (omitted variable)					
10 years or more	.0385	.0144	.4371	1,942	566
Other families and primary individuals	—.0549	.0321	.3970	—2,217	1,260
Race:					
White (omitted variable)					
Nonwhite	—.0688	.0238	.4650	—1,879	938
Education of household head:					
Under 8 years	—.1280	.0197	2.9064	—3,720	784
8–11 years	—.0542	.0133	.9972	—2,131	519
High school (omitted variable)					
College, 1–3 years	.0166	.0165	.0678	627	645
College, 4 or more years	.0374	.0138	.3486	1,724	602
Occupation of household head:					
Professional, managerial, etc (omitted variable)					
Craftsman, operatives, clerical	—.0280	.0131	.3236	—1,969	520
Farmers	.0289	.0439	.0100	2,975	1,706
Other reported	—.0330	.0170	.2168	—1,420	667
Not reported	—.0344	.0178	.2468	—1,872	698
Total income in dollars	.2797	.0199	21.3829	.4584	.0214

*SMSA—Standard Metropolitan Statistical Area.

Source: U.S. Department of Commerce, Office of Business Economics. Basic data are from 1/1,000 sample of the 1960 Census of Population and Housing.

Appendix Table 2.—Gross and Net Variation in Average Value of Houses Built 1959—First Quarter 1960

[Dollars]

Characteristic	Net difference [1]		Gross difference, average house value
	Linear regression (equation #1)	Log regression [1] (equation #3)	
Region:			
Northeast	3,196	3,110	4,720
North Central	1,971	2,540	2,980
South (omitted variable)			
West	1,892	1,940	4,110
Size of place:			
Rural nonfarm	1,514	1,130	(2)
Urban—less than 500,000	1,777	2,190	(2)
Urban—500,000 or more (omitted variable)			
Size of SMSA:*			
Outside SMSA	—2,931	—3,300	(2)
SMSA—1 million and over			
Central city	2,785	3,340	(2)
Not in central city (omitted variable)			
SMSA—under 1 million			
Central city	—1,317	—720	(2)
Not in central city	—1,282	—450	(2)
Age and sex of household head:			
Male under 25 years	—2,357	—1,880	—6,660
25–29 years	—1,135	—930	—3,460
30–44 years (omitted variable)			
45–64 years	142	350	—220
Male 65 and over and all females	3,377	5,300	—3,420
Marital status of household head:			
Married 2 years or less	—35	280	—1,870
3–9 years (omitted variable)			
10 years or more	1,942	1,840	2,950
Other families and primary individuals	—2,217	—2,500	—1,930
Race:			
White (omitted variable)			
Nonwhite	—1,879	—2,030	—6,070
Education of household head:			
Under 8 years	—3,720	—3,380	—5,100
8–11 years	—2,131	—1,690	—2,370
High school (omitted variable)			
College, 1–3 years	627	550	1,970
College, 4 or more years	1,724	1,270	4,400
Occupation of household head:			
Professional, managerial, etc. (omitted variable)			
Craftsmen, operatives, clerical	—1,969	—1,260	—3,490
Farmers	2,975	1,340	—6,620
Other reported	—1,420	—1,020	—4,040
Not reported	—1,872	—1,080	—5,240

*SMSA—Standard Metropolitan Statistical Area.

1. The first column is taken directly from Appendix table 1. Figures in the second column are derived from Appendix table 1; they are the linear equivalents of the relative changes from the log mean. The third column is based on the cross-tabulations from the 1/1,000 sample of the 1960 Census of Population and Housing. (See table 2 in text.)
2. Data are not comparable.

Source: U.S. Department of Commerce, Office of Business Economics. Basic data are from 1/1,000 sample of 1960 Census of Population and Housing.

Appendix Table 3.—Regression Summary for Value of New Houses Built 1959—First Quarter 1960

	Equation #1A (log)			Equation #1A (linear) (in millions)	
Total sum of squares	55.47868			79,348	
Due to regression	27.35689			36,190	
Deviations from regression	28.09039			43,453	
R^2	.493			.456	
Degrees of freedom	1,108			1,108	
Variable	Regression coefficient	Standard error	Mean square	Coefficient	Standard error
Constant	4.1246	0.0589		14,278	1,957
Region:					
Northeast	.2937	.0150	1.7968	3,017	581
North Central	.2676	.0136	1.4334	1,997	525
South (omitted variable)					
West	.0619	.0134	.3679	1,647	518
Size of place:					
Rural nonfarm	.0348	.0473	.0312	2,403	1,830
Urban—Less than 500,000	.0659	.0456	.1209	2,453	1,764
Urban—500,000 or more (omitted variable)					
Size of SMSA:*					
Outside SMSA	—.0997	.0150	1.2382	—2,509	581
SMSA—1 million and over					
Central city	.0094	.0151	.2387	3,478	1,745
Not in central city (omitted variable)					
SMSA—under 1 million					
Central city	—.0127	.0166	.0340	—535	640
Not in central city	—.0084	.0245	.0195	—979	951
Age and sex of household head:					
Male under 25 years	—.0553	.0207	.2579	—1,960	1,031
25–29 years	—.0329	.0163	.2977	—895	629
30–44 years (omitted variable)					
45–64 years	.0057	.0142	.0094	147	547
Male 65 and over and all females	.1239	.0965	1.2534	3,616	1,824
Marital status of household head:					
Married 2 years or less	.0075	.0235	.0060	—109	907
3–9 years (omitted variable)					
10 years or more	.0213	.0143	.2718	1,500	549
Other families and primary individuals	—.0729	.0323	.3390	—1,866	1,249
Race:					
White (omitted variable)					
Nonwhite	—.0762	.0233	.6061	—1,638	899
Education of household head:					
Under 8 years	—.1472	.0196	3.2226	—3,277	757
8–11 years	—.0582	.0133	.3310	—1,788	512
High school (omitted variable)					
College, 1–3 years	.0042	.0165	.0042	302	638
College, 4 or more years	.0285	.0154	.1994	1,155	594
Occupation of household head:					
Professional, managerial, etc. (omitted variable)					
Craftsmen, operatives, clerical	—.0353	.0132	.4146	—1,782	509
Farmers	.0173	.0263	.0037	1,661	3,721
Other reported	—.0366	.0170	.2724	—1,205	656
Not reported	—.0227	.0179	.0949	—1,489	692
Income of household head:					
Under $4,000	—.1139	.0263	1.8237	—2,455	738
$4,000–$4,999	—.0734	.0313	.8991	—2,200	921
$5,000–$5,999	—.0624	.0194	.8089	—282	751
$6,000–$6,999 (omitted variable)					
$7,000–$7,999	.0345	.0194	.3935	1,370	749
$8,000–$8,999	.0721	.0204	.7235	2,308	788
$9,000–$9,999	.0477	.0228	.2563	1,849	882
$10,000–$11,999	.0664	.0204	1.2960	3,775	786
$12,000–$14,999	.1396	.0286	1.8741	6,417	950
$15,000–$19,999	.1897	.0311	2.1561	9,639	1,202
$20,000–$24,999	.2245	.0431	1.7151	13,402	1,665
$25,000 or more	.2660	.0800	2.5606	15,454	1,547

*SMSA—Standard Metropolitan Statistical Area.

Source: U.S. Department of Commerce, Office of Business Economics. Basic data are from 1/1,000 sample of the 1960 Census of Population and Housing.

Appendix Table 4.—Influence of Selected Characteristics on Variation in Average Value of New Houses Built 1959—First Quarter 1960

[Values in dollars]

Characteristic	Number	Value of house				Income		
		Average	Gross differences from U.S. average	Gross differences adjusted for differences in income (col. C+E)	Net differences from U.S. average	Average	Gross differences from U.S. average	Income adjustment (col. G times .4564)
	(A)	(B)	(C)	(D)	(E)	(F)	(G)	(H)
Average		16,574				7,875		
Age and sex of household head								
Male:								
Under 25 years	68	11,380	—5,194	—3,854	—2,361	4,951	—2,924	1,340
25–29 years	280	14,486	—2,094	—1,421	—1,129	5,487	—1,468	673
30–44 years	665	17,941	1,367	1,013	—4	8,336	761	—349
45–64 years	215	17,621	1,047	52	138	10,046	2,171	—985
65 and over, plus all females	197	14,521	—2,053	—324	3,373	4,104	—3,771	1,720
Marital status of household head								
Husband-wife married:								
0–2 years	70	13,330	—3,244	—2,269	—963	5,747	—2,128	975
3–9 years	351	15,226	—1,374	—849	—945	6,728	—1,147	526
10 years and over	535	18,047	1,473	378	994	9,172	1,297	—595
Other families and primary individuals	79	12,973	—3,201	—1,468	—3,166	4,094	—3,781	1,733
Region								
Northeast	184	18,910	2,336	2,170	1,790	8,238	363	—166
North Central	231	17,170	596	519	558	8,044	168	—77
South	455	14,180	—2,394	—1,874	—1,408	6,782	—1,113	510
West	255	18,300	1,726	1,062	496	9,324	1,449	—664
Race								
White	1,109	16,820	246	257	75	7,851	—24	11
Nonwhite	46	10,750	—5,824	—4,271	—1,904	4,705	—3,170	1,453
Education of household head								
Under 8 years	128	11,680	—4,944	—3,831	—3,092	5,448	—2,427	1,112
8–11 years	238	14,450	—2,124	—1,501	—1,503	6,546	—1,329	623
High school	335	16,830	256	180	628	8,094	219	—96
College, 1–3 years	145	18,780	2,216	1,630	1,455	9,154	1,279	—585
College, 4 or more years	207	21,229	4,665	3,492	2,352	10,902	3,027	—1,384
Occupation of household head								
Professional, managerial, etc.	399	20,534	3,960	3,537	1,064	16,880	3,105	—1,423
Craftsman, operatives, and clerical	529	15,132	—1,442	—1,109	—806	7,148	—727	333
Farmers	52	13,939	—2,635	—1,855	4,039	6,173	—1,702	780
Other reported	174	15,591	—983	—466	—356	6,748	—1,127	517
Not reported	81	15,291	—1,283	—1,147	—808	7,578	—297	—136

Gross differences are based on cross-tabulation shown in table 2; net differences are based on linear equation #1.

NOTE.—The mean value of all new houses combined (U.S. average) used to compute gross differences from the U.S. average was somewhat lower than that used to compute net differences. This is traceable to the fact that of the 1,398 buyers of new houses, only 1,155 reported house value. In the cross-tabulation (on which the gross differences are based), all 1,398 households were used to derive the U.S. average; imputations were employed for those households not reporting house value. In the correlation, only the 1,155 observations were used. The 243 households that did not report value of house had incomes which averaged lower than the 1,155 who did report; the inclusion of imputed values for the former lowers the average house value for the U.S. Since the comparisons are in terms of deviations from means rather than in terms of the means, it is believed that the differences between the means introduces relatively little distortion.

Source: U.S. Department of Commerce, Office of Business Economics. Basic data are from 1/1,000 sample of the 1960 Census of Population and Housing.

Appendix Table 5.—Data for First Time Series Equation (Page 33)

Year	Inc.	P	CCF	$\sqrt{V}_{FHA}$ (actual)	$\sqrt{V}_{FHA}$ (calculated)	Year	Inc.	P	CCF	$\sqrt{V}_{FHA}$ (actual)	$\sqrt{V}_{FHA}$ (calculated)
1947	5,107	0.9579	0.0514	10,486	10,759	1956	6,901	1.0116	0.0555	14,205	14,329
1948	5,261	.9672	.0531	11,405	11,229	1957	7,279	1.0174	.0595	14,917	14,809
1949	5,245	.9631	.0534	11,291	11,288	1958	7,230	1.0000	.0634	14,596	14,554
1950	5,052	.9667	.0464	10,716	10,789	1959	7,224	1.0098	.0565	14,405	14,218
1951	5,262	.9797	.0433	11,084	11,089	1960	7,370	1.0087	.0598	14,400	14,349
1952	5,790	.9702	.0481	12,376	12,355	1961	7,438	1.0097	.0588	14,618	14,690
1953	5,767	.9804	.0529	11,934	12,180	1962	7,852	1.0172	.0634	14,674	14,619
1954	6,054	.9648	.0517	12,226	12,370	1963	7,523	1.0211	.0544	14,908	14,876
1955	6,439	.9957	.0533	13,277	13,560	1964	7,853	1.0229	.0590	14,913	14,900

NOTE: Inc.=deflated "effective income" (in 1958 dollars) of FHA home buyers.
P=deflated price index for a standardized FHA house (1958=100).
CCF=composite credit factor.
$\sqrt{V}_{FHA}$=deflated value of FHA new one-family houses in 1958 dollars.